

Cephalograms & Other 2D Extraoral Views

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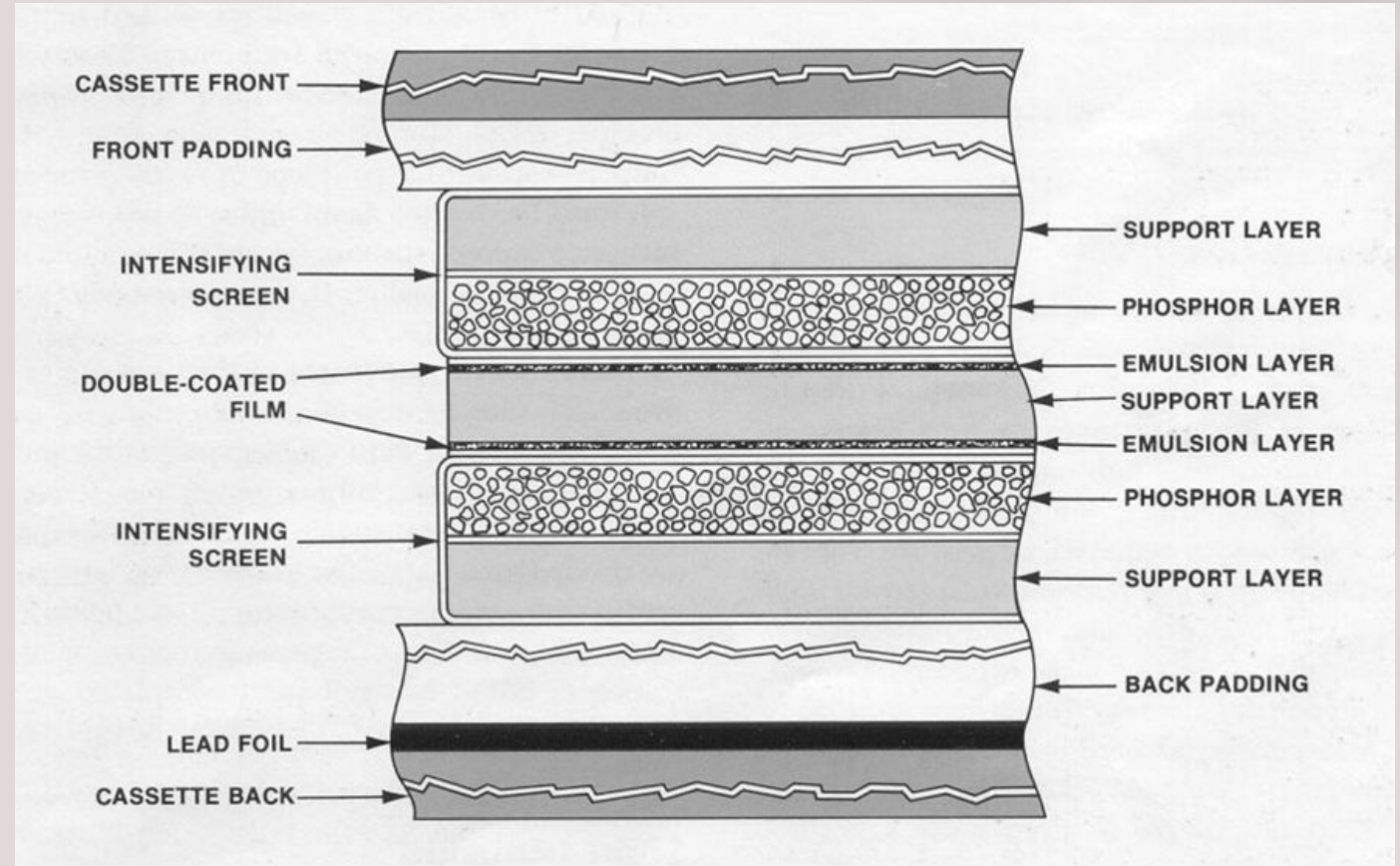
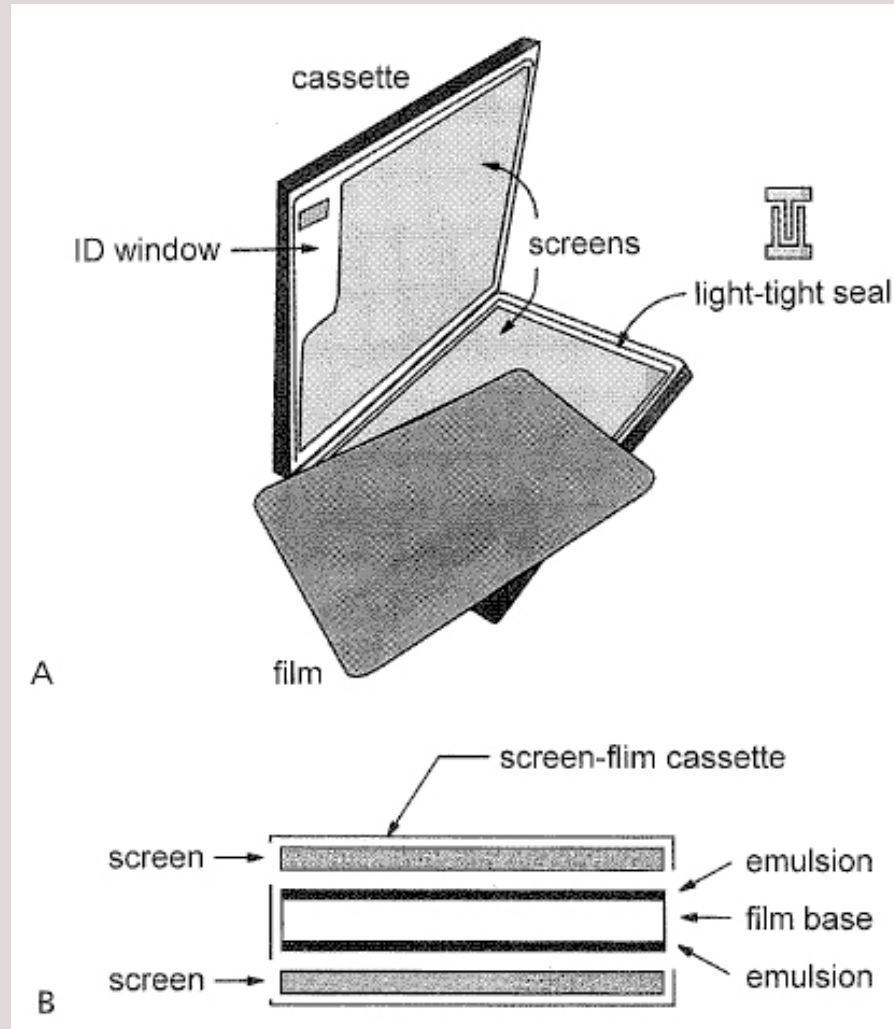
Learning Objectives

- What are intensifying screens?
- Understanding the purpose of using intensifying screens in extraoral radiography
- Understanding differences between Cephalograms and Skull Views
- What are the clinical indications for:
 - Lateral cephalogram (Lat Ceph)
 - Frontal Views
 - Submentovertex (SMV) Projection
 - Water's View
 - Reverse Towne View
 - Lateral Oblique (or Oblique Lateral) Radiograph

Extraoral Radiography

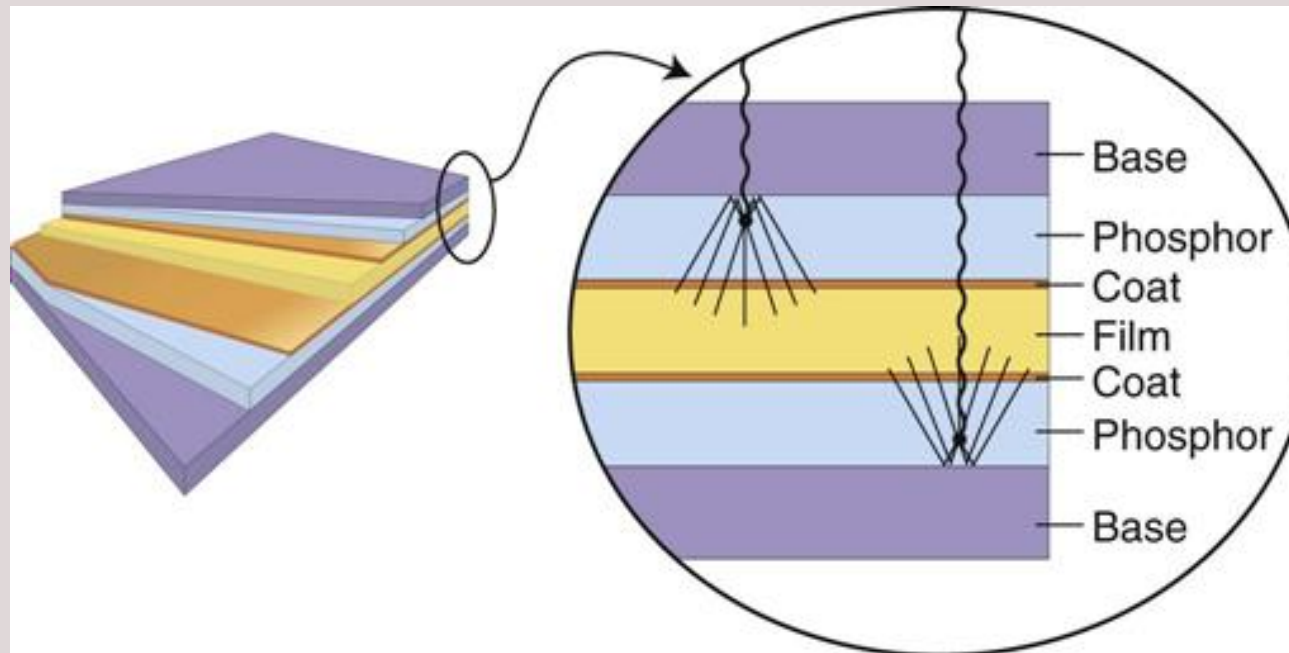
- Extra(=outside)Oral(=mouth) Radiography
 - X-ray source and image receptor are placed OUTSIDE the mouth
- General indications:
 - Patient is unable to open mouth
 - Severe gag reflex
 - Trauma
 - Impacted third molars
 - Extensive jaw pathology
 - TM joint assessment
 - Orthodontic & orthognathic treatment planning

X-ray Cassette (Analogue)



Intensifying Screen

- Used to reduce radiation exposure
- Film (AgBr) is sensitive to UV and *blue light*
- Intensifying screen makes the film 10-60 times more sensitive to x-rays
- Screens are placed on each side of the film (double coated film) to help increase image sharpness.



Intensifying Screen

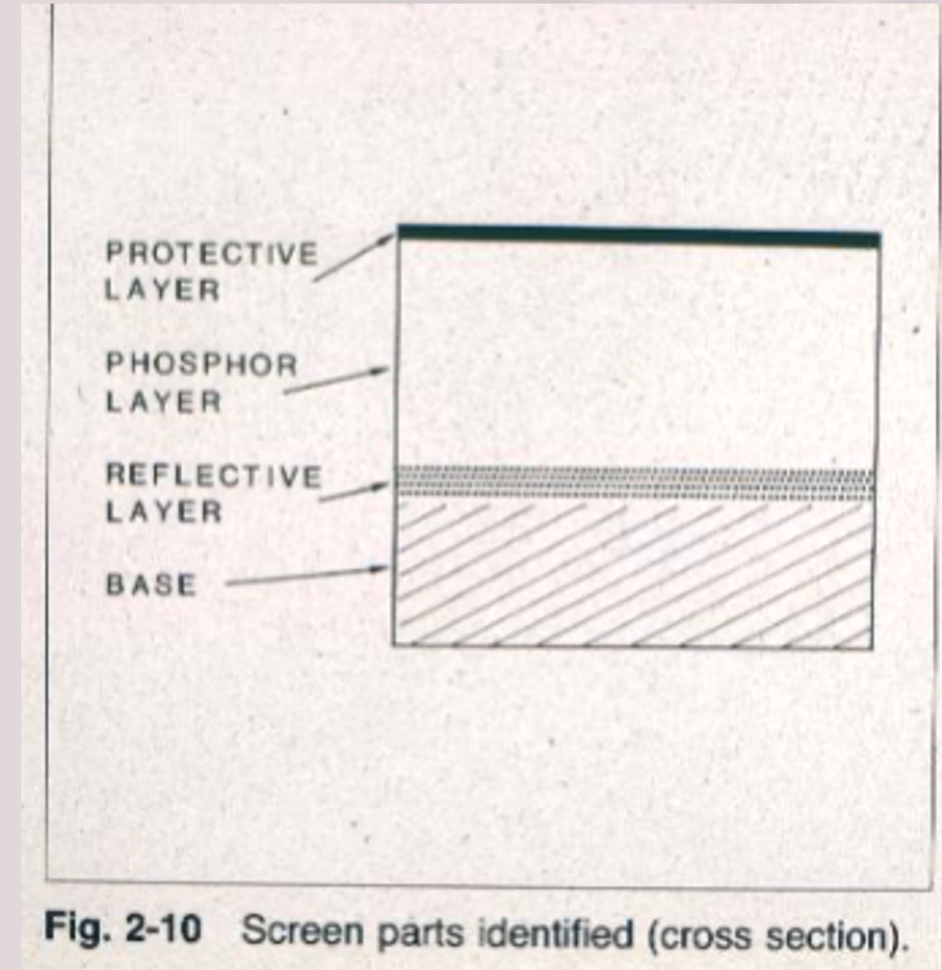
Phosphor layer

- Composed of **phosphor crystals**
 - **Inorganic salts**
 - calcium tungstate (CaWO_4): blue light
 - lanthanum oxybromide (LaOBr): blue light
 - gadolinium oxysulfide ($\text{Gd}_2\text{O}_2\text{S}$): green light
 - **Rare earth elements**
 - Have better light conversion efficacy
 - Lanthanum, gadolinium and yttrium

Intensifying Screen

Base + Reflective Layer

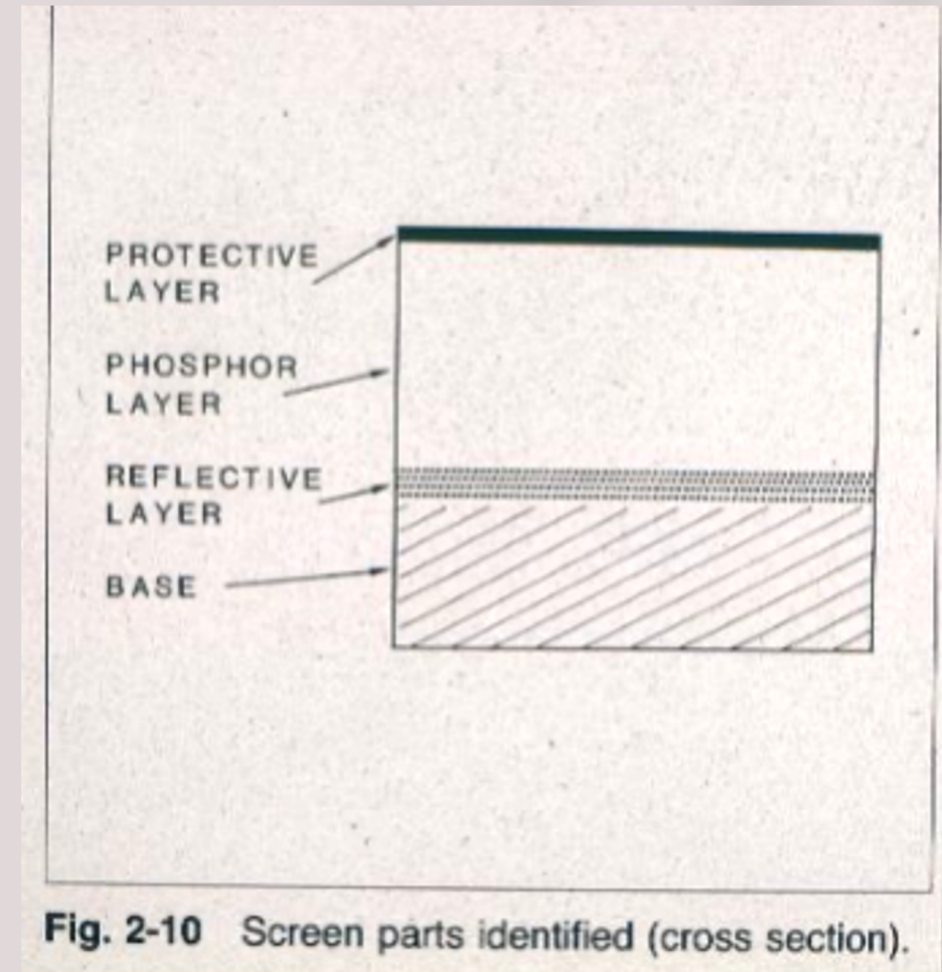
- *Base = Polyester plastic that ~0.25 mm thick (mechanical support)*
- Reflective layer reflects light emitted from the phosphor layer back toward the x-ray film
 - This reflective base increases the light emission of the intensifying screen but also results in image fogging "unsharpness" because of the divergence of light rays reflected back to the film.



Intensifying Screen

Protective layer

- Polymer coat ($\leq 15 \mu\text{m}$ thick) is placed over the phosphor layer to protect the phosphor and to provide a surface that can be cleaned



Intensifying Screen – Screen-Film Speed

- Fast screen-films are used in dentistry (speed of 400 or more)
- They contain large phosphor crystals
 - Thick
 - Reduced radiation exposure
 - Rapidly conversion of x-ray photons into visible light at the expense of decreased image sharpness

TABLE 5-3. Speed class of various screen-film combinations*

Screens		Films	
<i>Kodak</i>		<i>TMG, TML</i>	<i>TMH</i>
<i>Lanex</i>	<i>Fine</i>	100	250
	<i>Medium</i>	250	600
	<i>Regular</i>	400	800
	<i>Fast</i>	600	1200
<i>3M</i>		<i>XD/A, XL/A</i>	<i>XM</i>
<i>Trimax</i>	<i>2</i>	100	
	<i>4</i>	200	
	<i>8</i>	400	800
	<i>12</i>	600	1200
<i>Du Pont</i>		<i>10T, 10TL</i>	
<i>Quanta</i>	<i>Detail</i>	100	
	<i>Fast Detail</i>	200	
	<i>Rapid</i>	400	
TMG, XD/A, 10T:		Medium detail, medium speed, high contrast	
TML, XL/A, 10TL:		Medium detail, medium speed, wide latitude	
TMH, XM		Low detail, high speed, high contrast	

*The descriptions of these films should be used only to compare the films with others by the same manufacturer.

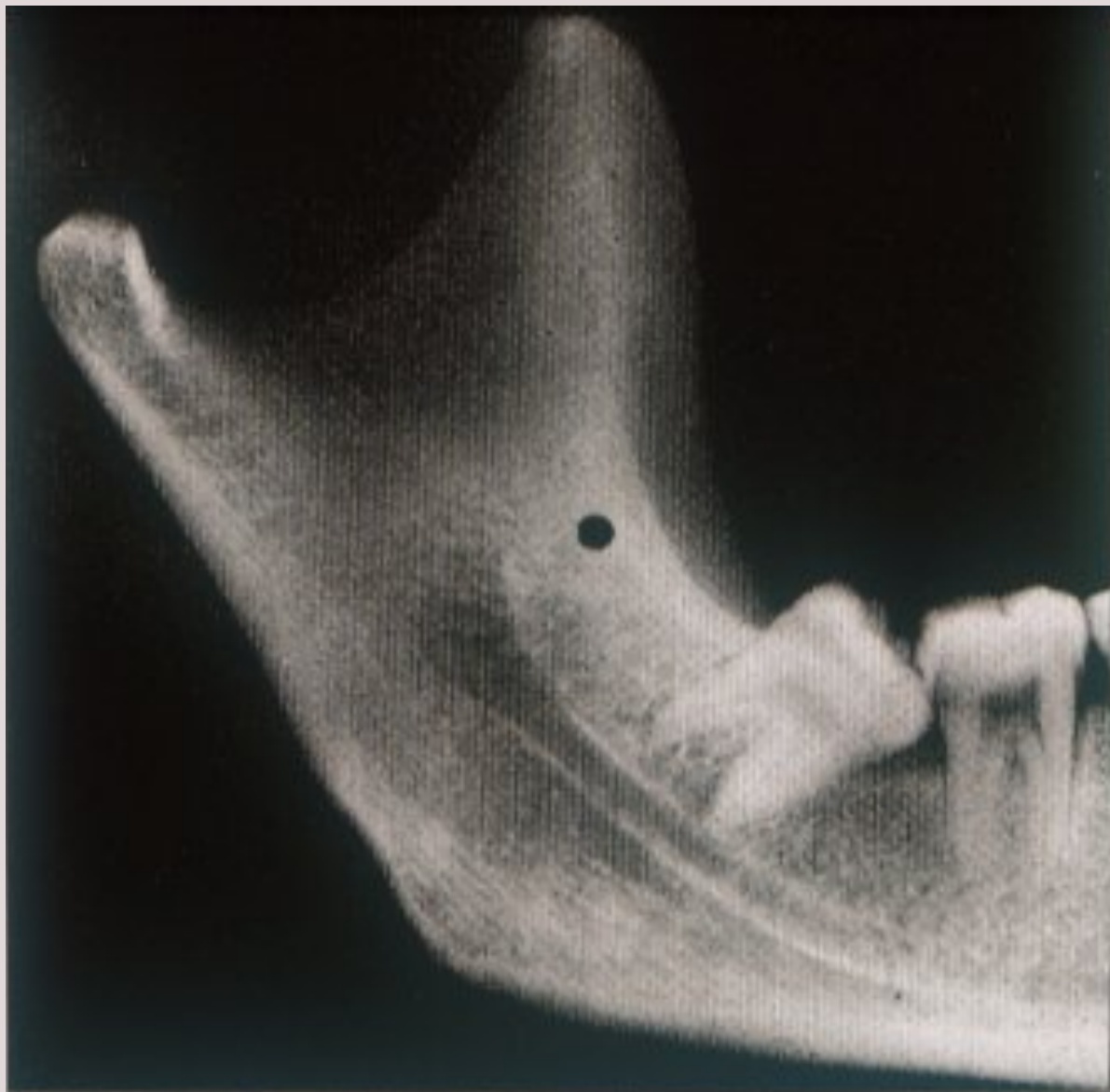
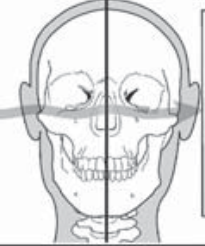
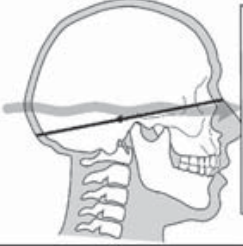
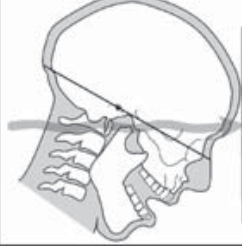
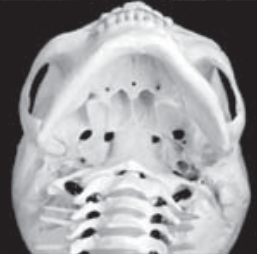
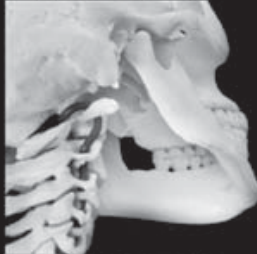
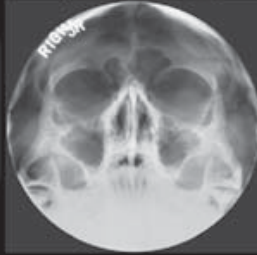
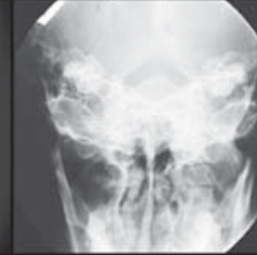
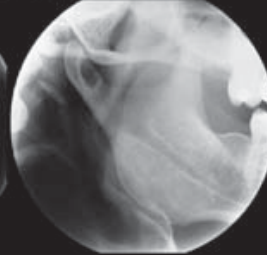


Fig. 2-9a Resulting image patterns of mandible exposed on film directly.



Fig. 2-9b On film/screen combination.

Common Extra-oral Views

	Lateral Ceph	SMV	Waters	PA Ceph	Reverse Towne	Oblique	Lateral Ramus
Patient placement	Film parallel to midsagittal plane	Canthomeatal line parallel to film	Canthomeatal line at 37° with film	Canthomeatal line at 10° with film	Canthomeatal line at -30° with film	Film in contact with cheek at molar area	Film in contact with cheek at ramus area
Central beam	Beam perpendicular to film	Beam perpendicular to film	Beam perpendicular to film	Beam perpendicular to film	Beam perpendicular to film	Beam aims at the molar- premolar area	Beam aims at the ramus area
Diagram of patient placement							
Illustration of patient placement							
Skull view							
Resultant image							

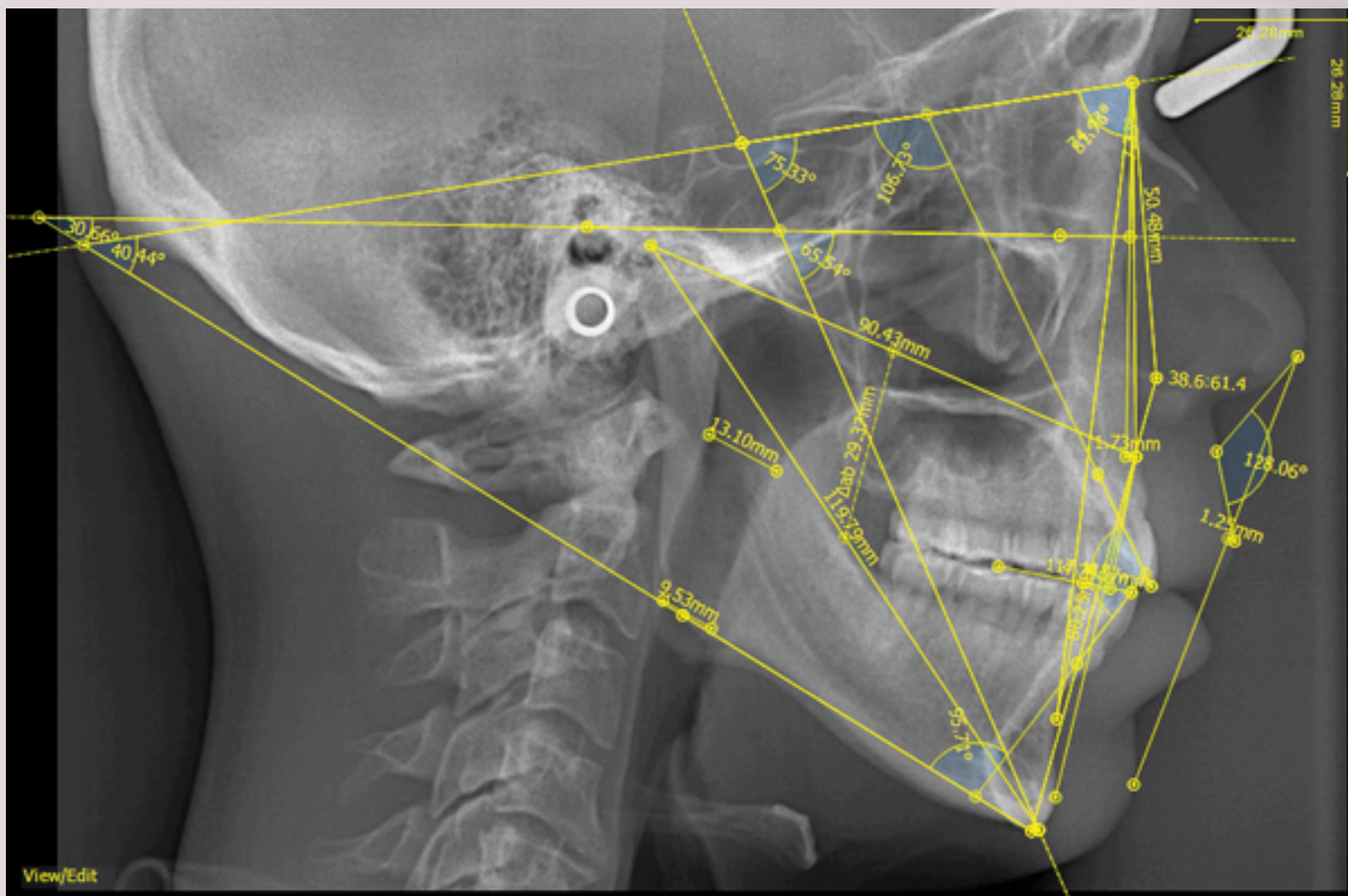
Lateral Cephalogram (Lat Ceph)

CEPHALOSTAT

- Cephalogram = standardised view
 - Reproducible
- True Lateral Skull projection
 - Midsagittal line parallel to film
 - X-ray beam perpendicular to film
- Soft tissue definition achieved by aluminium wedge filter
- Indications:
 - **Orthodontic and orthognathic assessment (pre, peri and post)**
 - Anteroposterior (AP) relationships between the maxilla, mandible, and cranial base
 - Skeletal, dental and soft tissue relationships
 - *Other (less common)*
 - *Skull bone disorder (Paget's, Multiple myeloma, hyperparathyroidism etc.)*
 - *Paranasal sinus diseases*
 - *Trauma*
 - *Cranial base and Midface*



FIG. 11-4. Patient positioning for a lateral cephalometric projection of the facial bones.

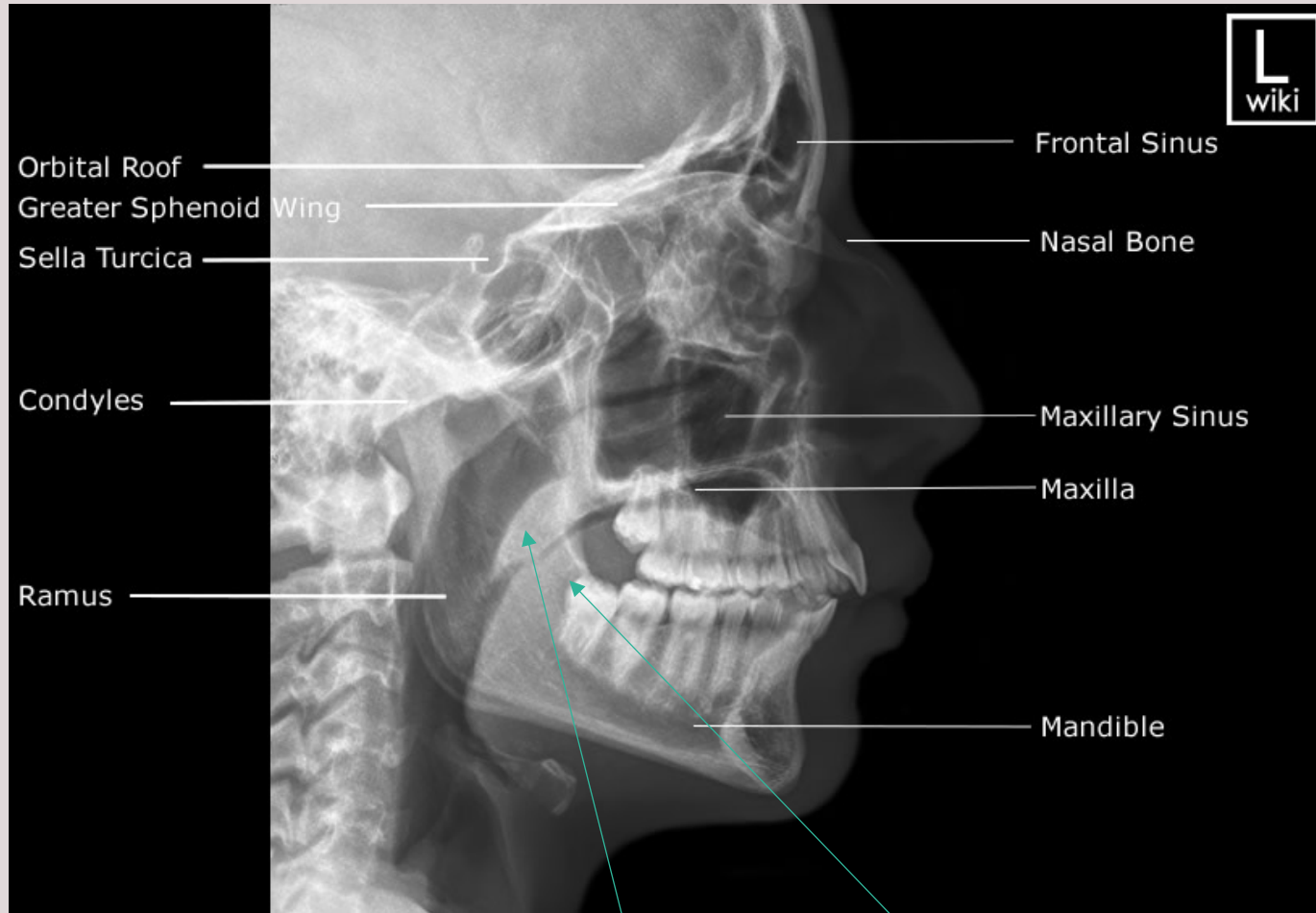


Lat Ceph Patient Positioning

- Patient placed in cephalostat
- Midsagittal line parallel to receptor
- Frankfort plane horizontal to floor
- Markers – forehead / infraorbital rests, and ear rods
- Teeth in maximum intercuspation (MIP) OR mandible in most retruded position with posterior teeth occluding
- Lips fully rested (closed or open)



Lat Ceph Anatomy



Cervical spine

Soft palate

tongue

Lat Ceph Landmarks

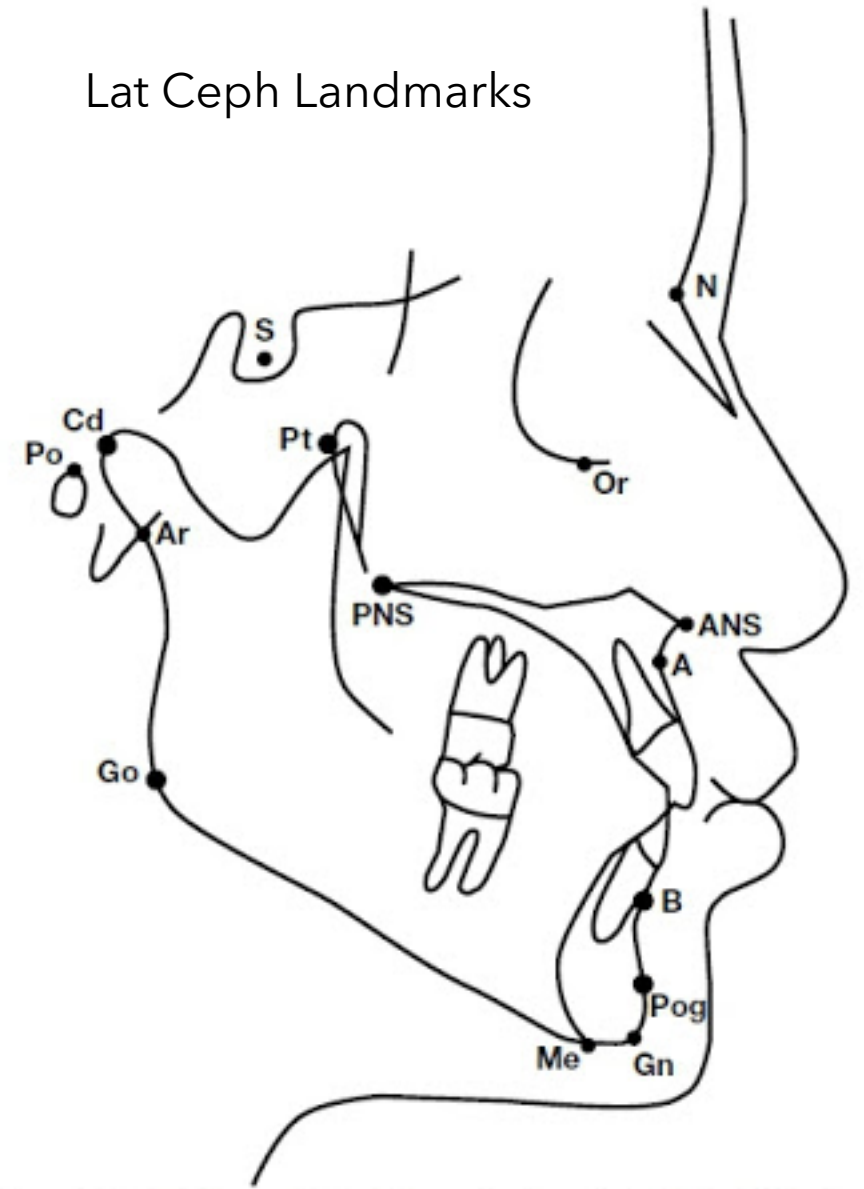


Figure 1. Cephalometric hard tissue landmarks: (S-Sella; N-Nasion; Po-Prion; Cd-Condylion; Pt-Pterygomaxillary fissure; Or-Orbitale; Ar-Articulare; PNS-Posterior nasal spine; ANS-Anterior nasal spine; A-A point; B-B point; Pog-Pogonion; Gn-Gnathion; Me-Menton).

Anatomy + Landmarks Labelled

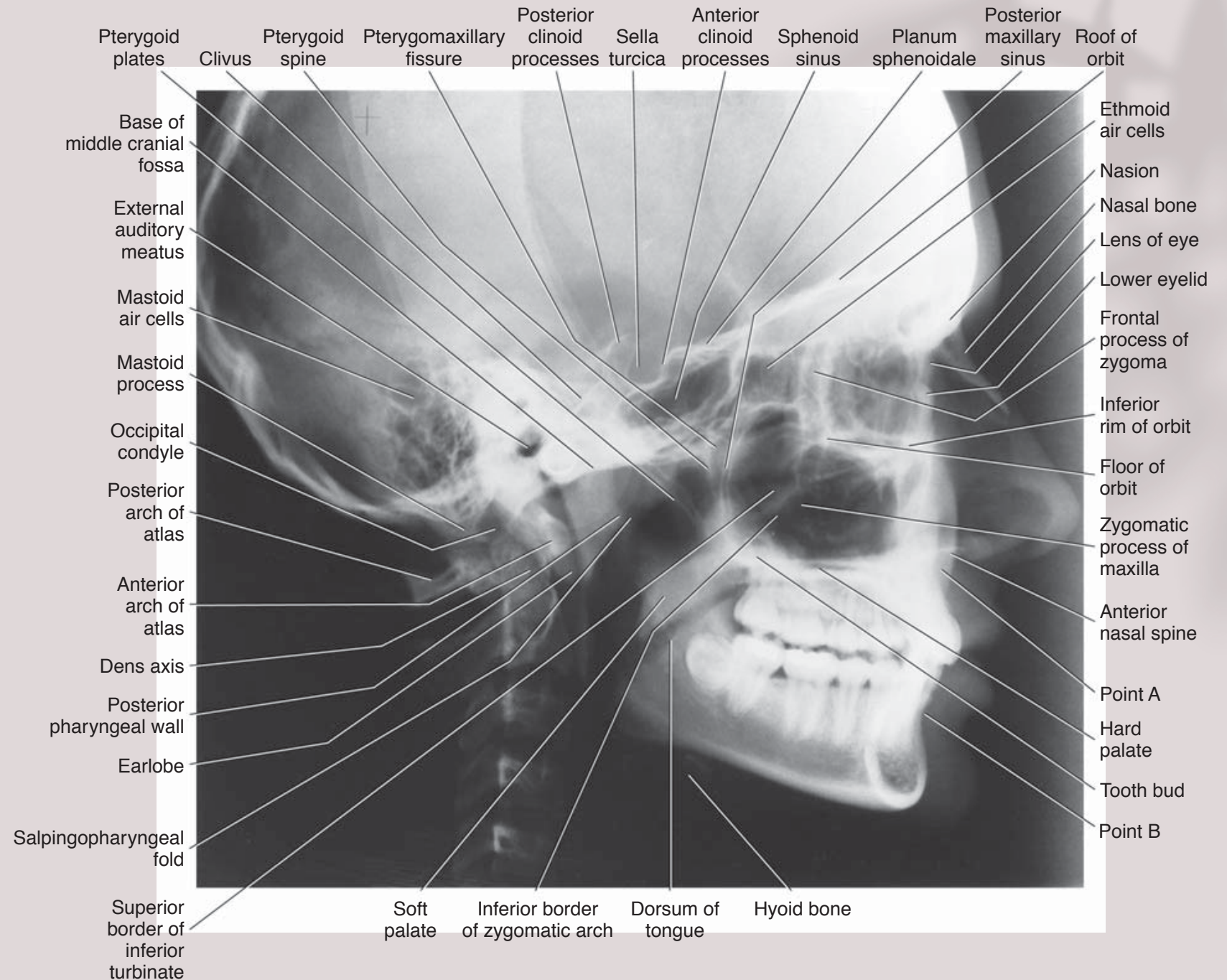


FIG. 12-1 Anatomic landmarks identified in the lateral cephalometric projection.

Anatomy Practice Lat Ceph



Postero-anterior (PA) / Frontal Projections

- Frontal / PA Ceph, PA Skull, PA Mandible, Rotated PA,
- Indications:
 - **PA Ceph:** Facial asymmetry (developmental or traumatic)
 - **PA Skull**
 - Trauma
 - Paranasal sinuses
 - Skull bone disorders (Paget's disease, Multiple myeloma, and Hyperparathyroidism)
 - **PA Mandible**
 - Fractures (post 1/3 body, angles, rami, and low condylar necks).
- Patient positioning:
 - Canthomeatal line 0 to +10°
 - 0° for PA skull, PA mandible
 - **+10° for PA CEPH**
 - Chin and forehead touch film
 - Beam perpendicular to film horizontal

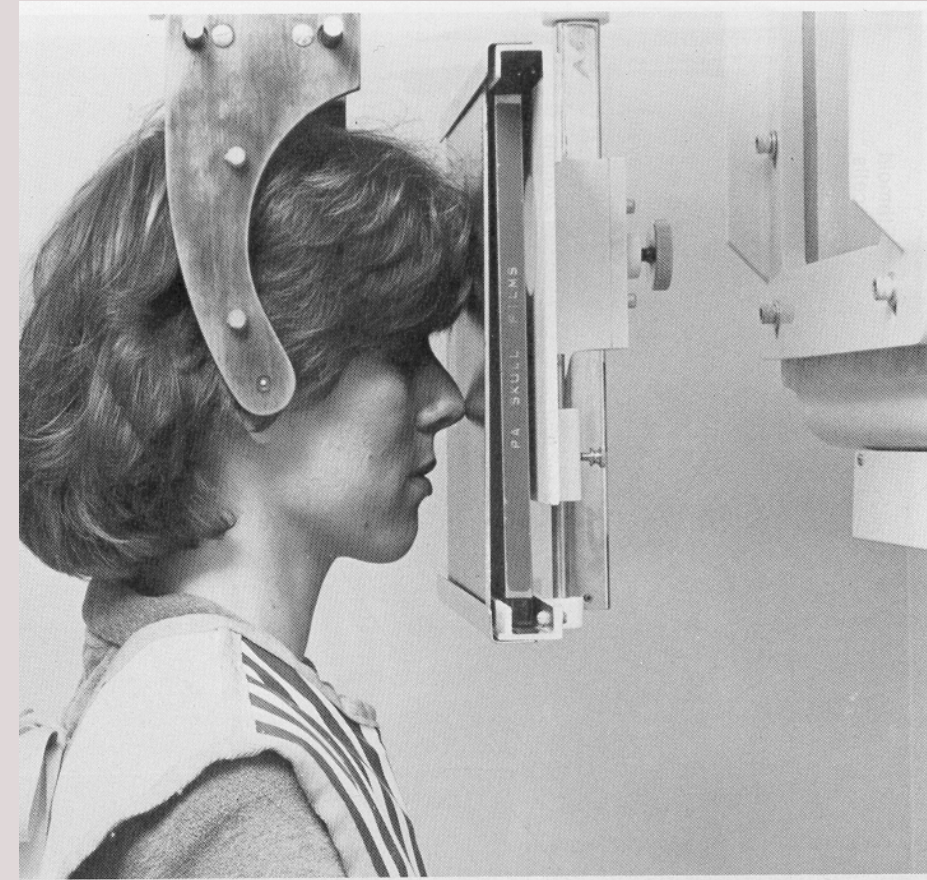
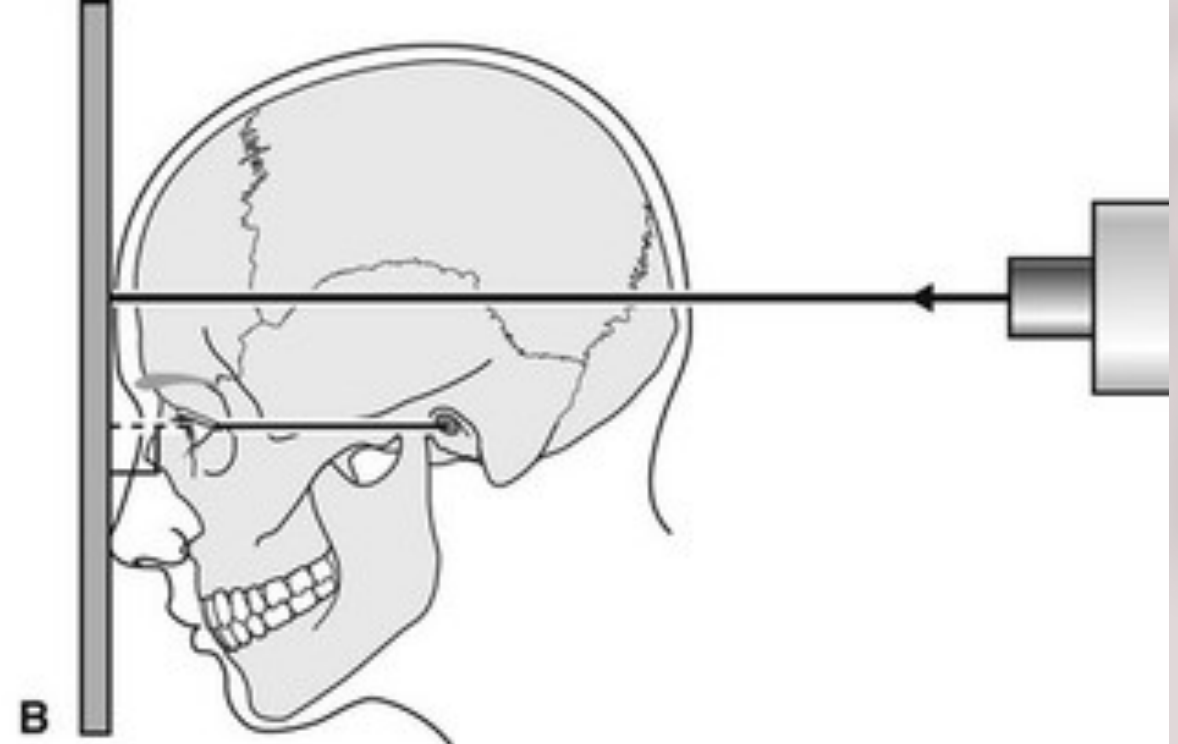
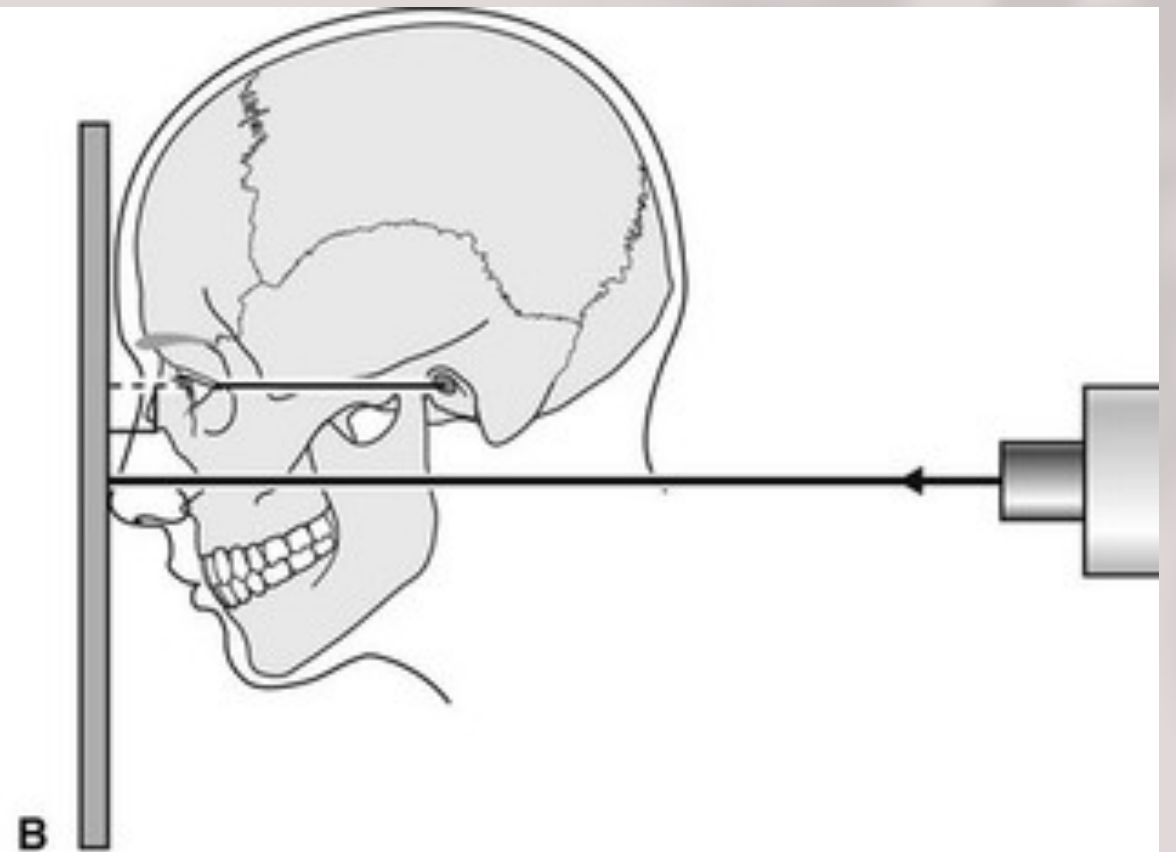


FIG. 11-2. Patient positioning for a posteroanterior cephalometric projection of the skull.

PA Ceph



PA Skull

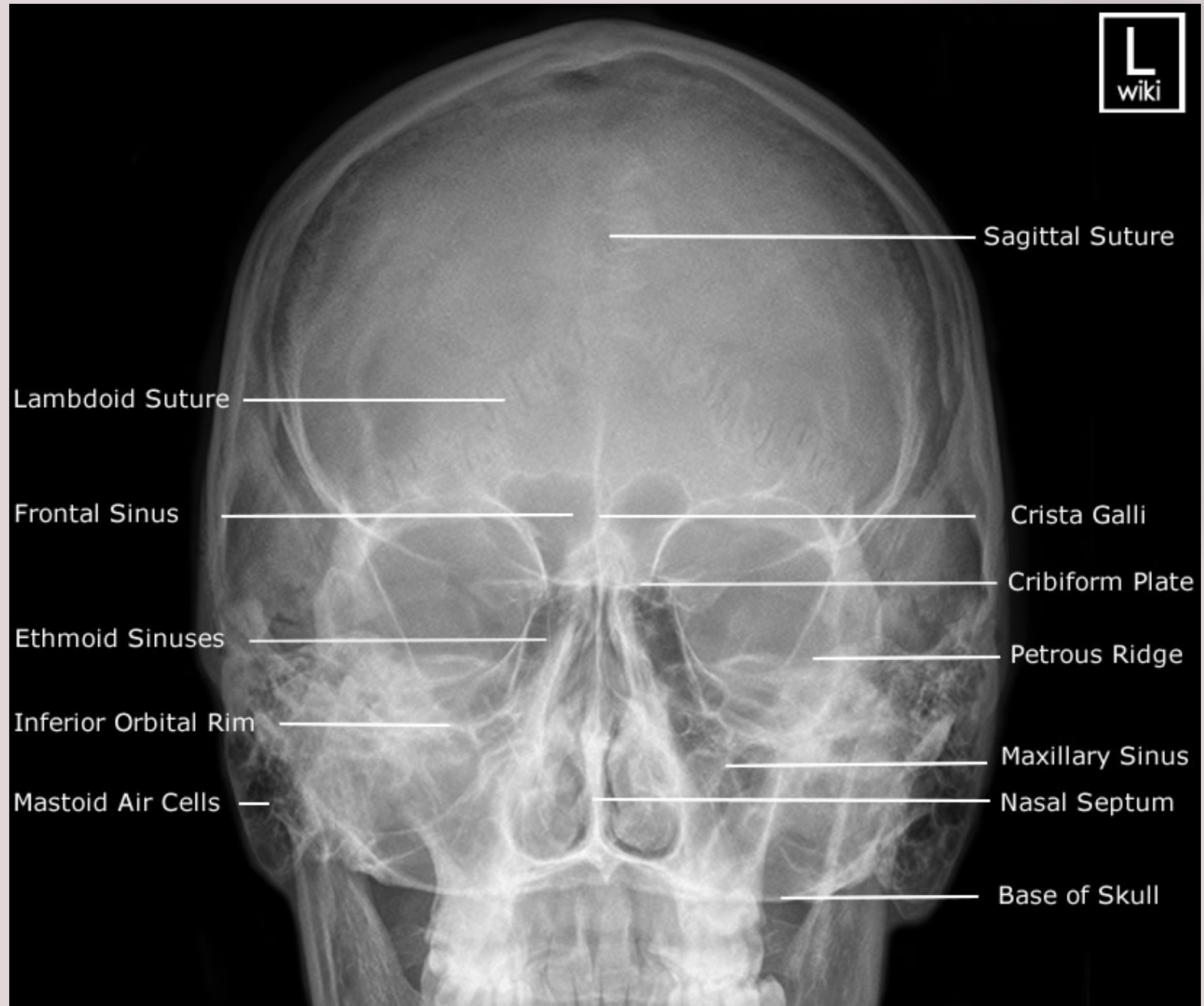


PA Jaw / MD

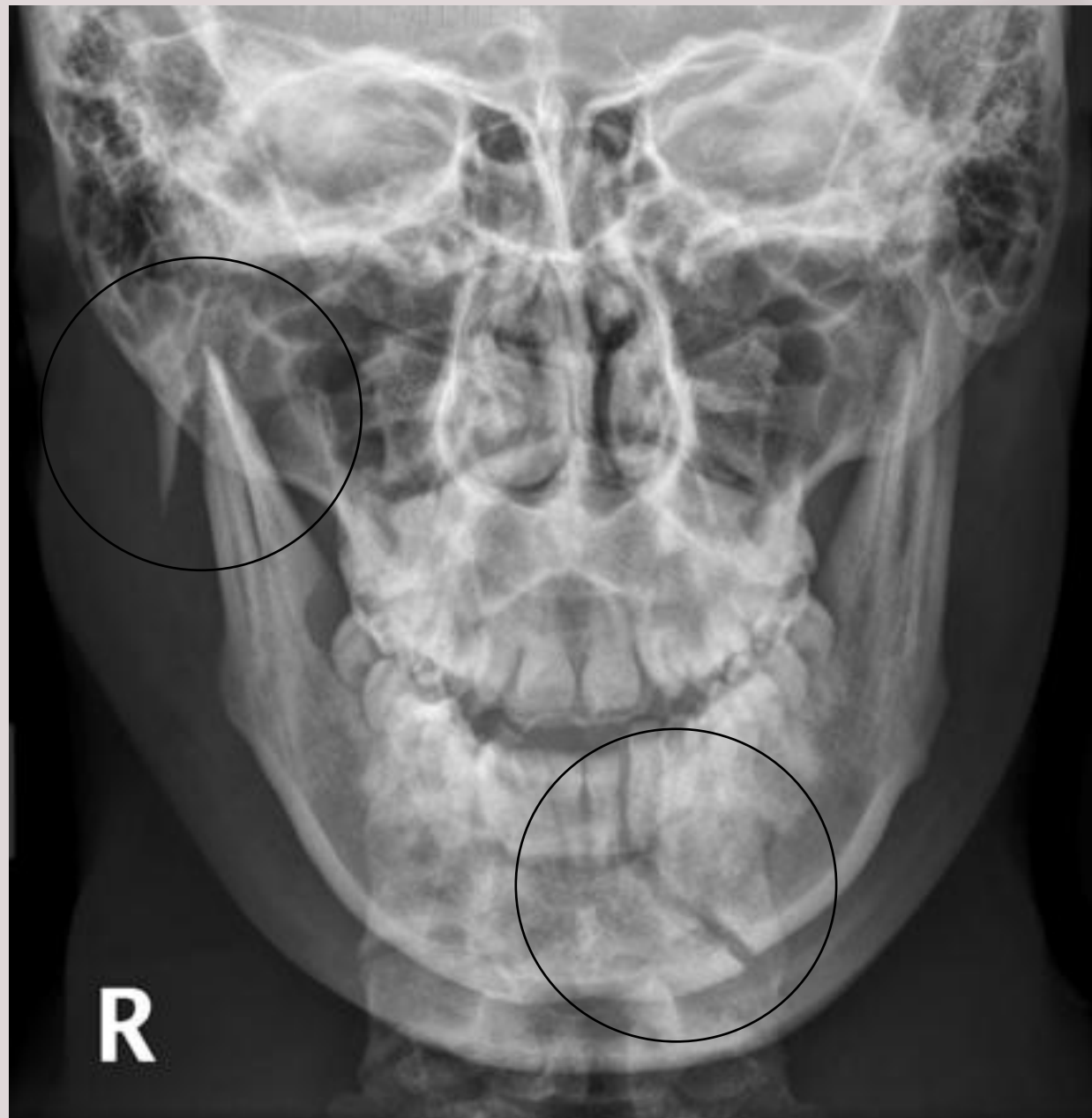
PA
Cephalogram



PA Skull



PA Jaw / MD



<http://www.wikiradiography.net/photo/10803904/PA+mandible>

SMV (Submentoververtex)

- Axial plane
- Positioning:
 - Chin up
 - Canthomeatal line parallel to film.
 - X-ray beam perpendicular to film (or up to -5°)
- Indications:
 - **Zygomatic arch fractures**
 - Thickness of body of mandible
 - Skull base
- **Contraindicated** in patients with suspected neck injuries, especially suspected fracture of the odontoid peg.

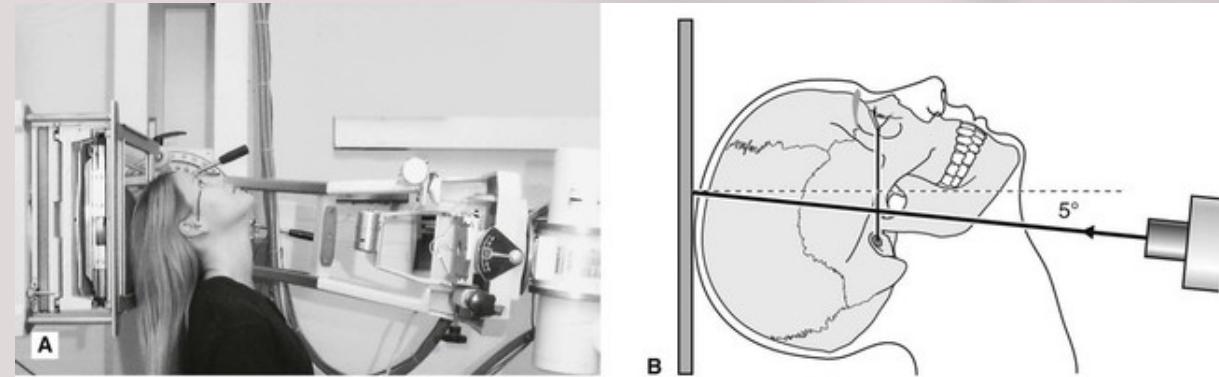


FIG. 11-10. Patient positioning for a submentoververtex projection of the skull.

SMV Anatomy

Upper and lower incisors
superimposed

Lateral wall of the
orbit

Anterior margin of the
middle cranial fossa

Lateral pterygoid
plate

Articular eminence

Condylar head

Anterior arch of the
atlas (C1)

Foramen magnum

Mastoid air cells

Frontal sinus

Zygomatic arch

Postero-lateral wall of
the maxillary antrum

Sphenoidal sinus

Foramen ovale

Foramen spinosum

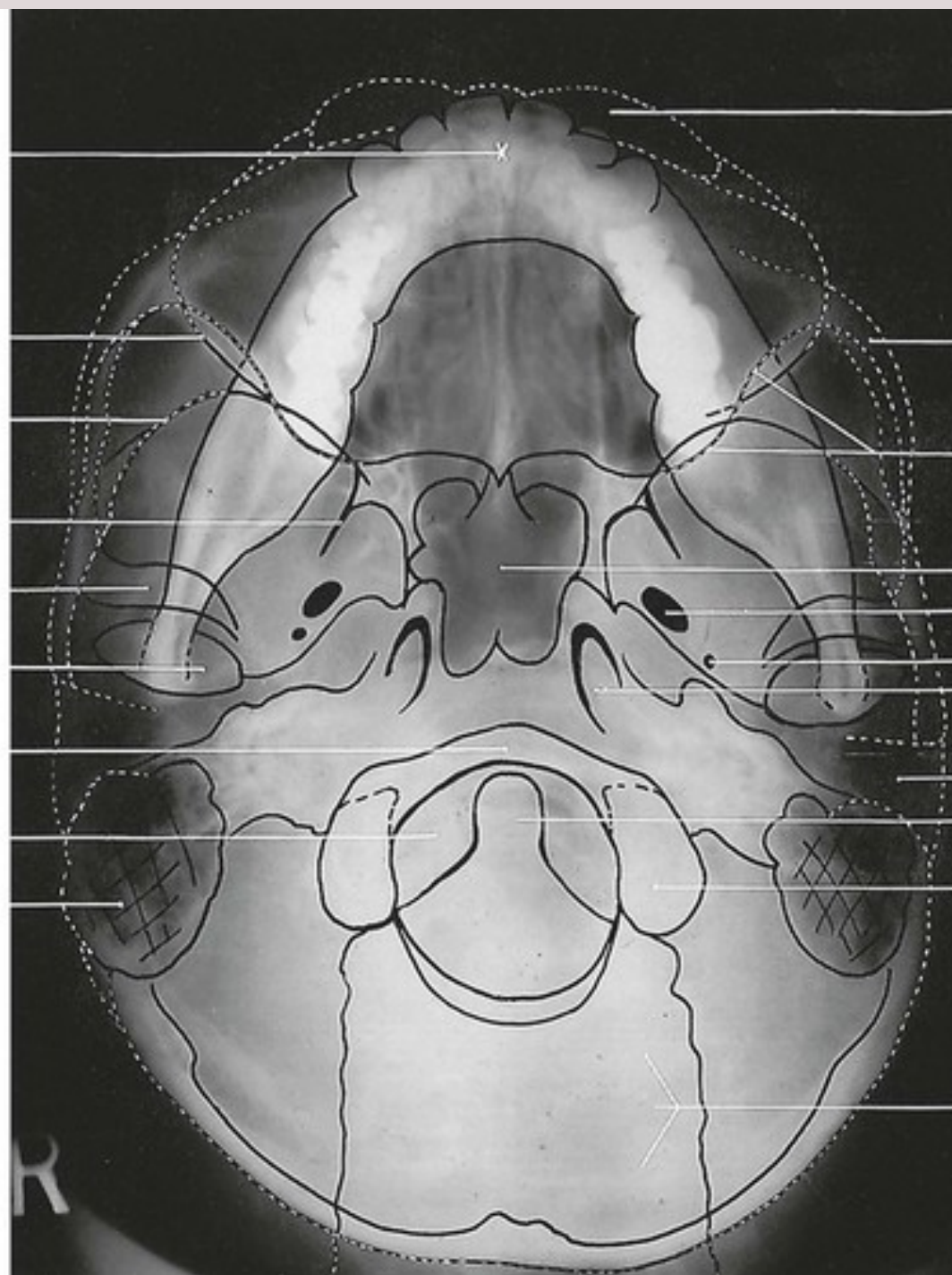
Foramen lacerum

Auditory canal

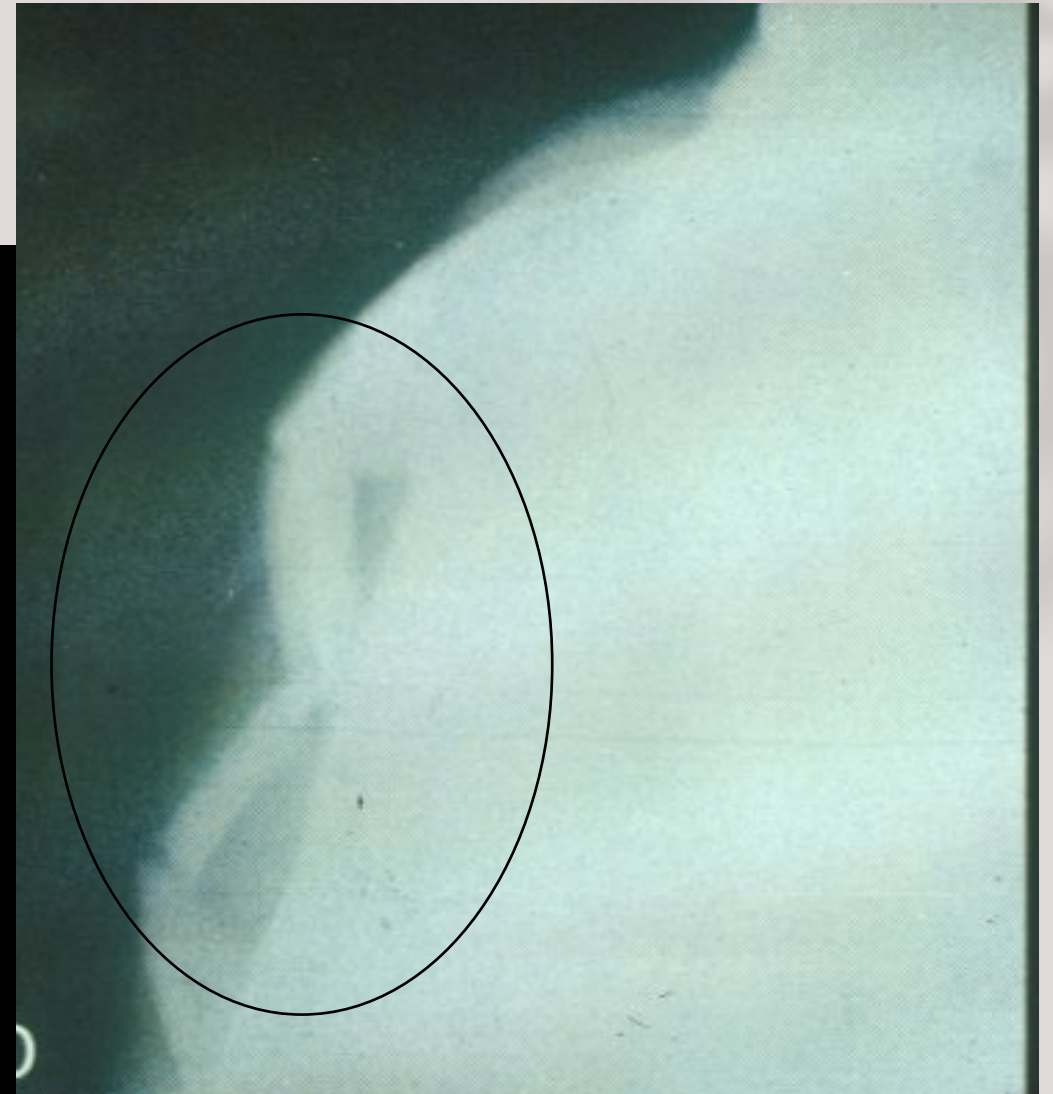
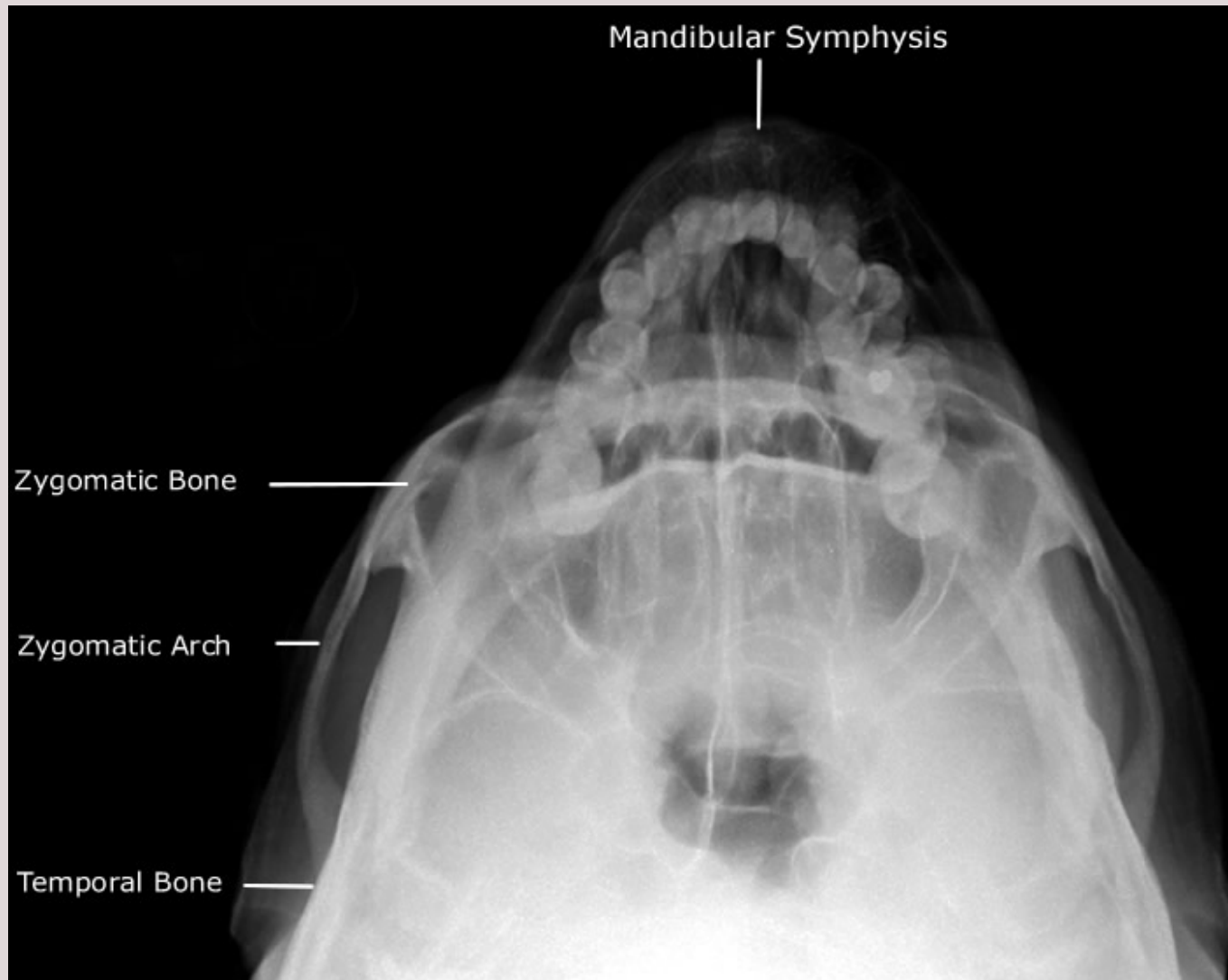
Odontoid peg (C2)

Occipital condyle

Shadow of the cervical
spine



"Jug Handle View"



Right zygomatic arch fracture

Waters view

- Positioning
 - Canthomeatal line at 37° to 45° to film
 - X-ray beam perpendicular to film (standard)
 - Modified Water's view aka '30° Occipitomeatal'
 - X-ray beam at $+30^{\circ}$ to horizontal / floor
- Indications:
 - **Paranasal sinuses (maxillary, frontal, and ethmoid).**
 - If assessing the sphenoid sinus, image needs to be taken with mouth open.
 - **Midface fractures (Le Fort I/II/III, zygomatic complex, naso-ethmoidal complex, and orbital blow-out).**
 - If midface fracture is suspected. Both standard and modified views are required for traditional imaging.

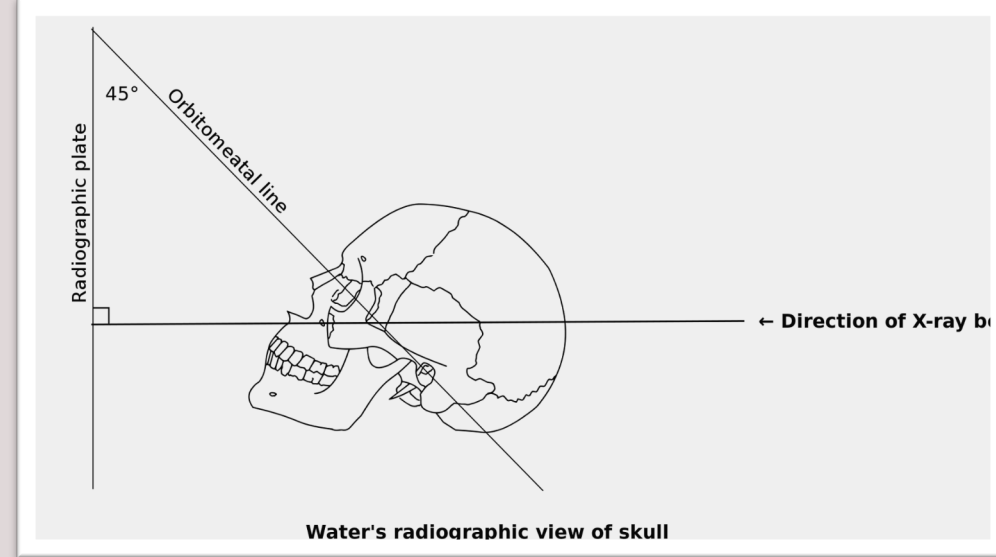


FIG. 11-6. Patient positioning for a Waters projection of the skull.

Frontal sinus

Orbit

Nasal septum

Posterior margin of the
anterior cranial fossa

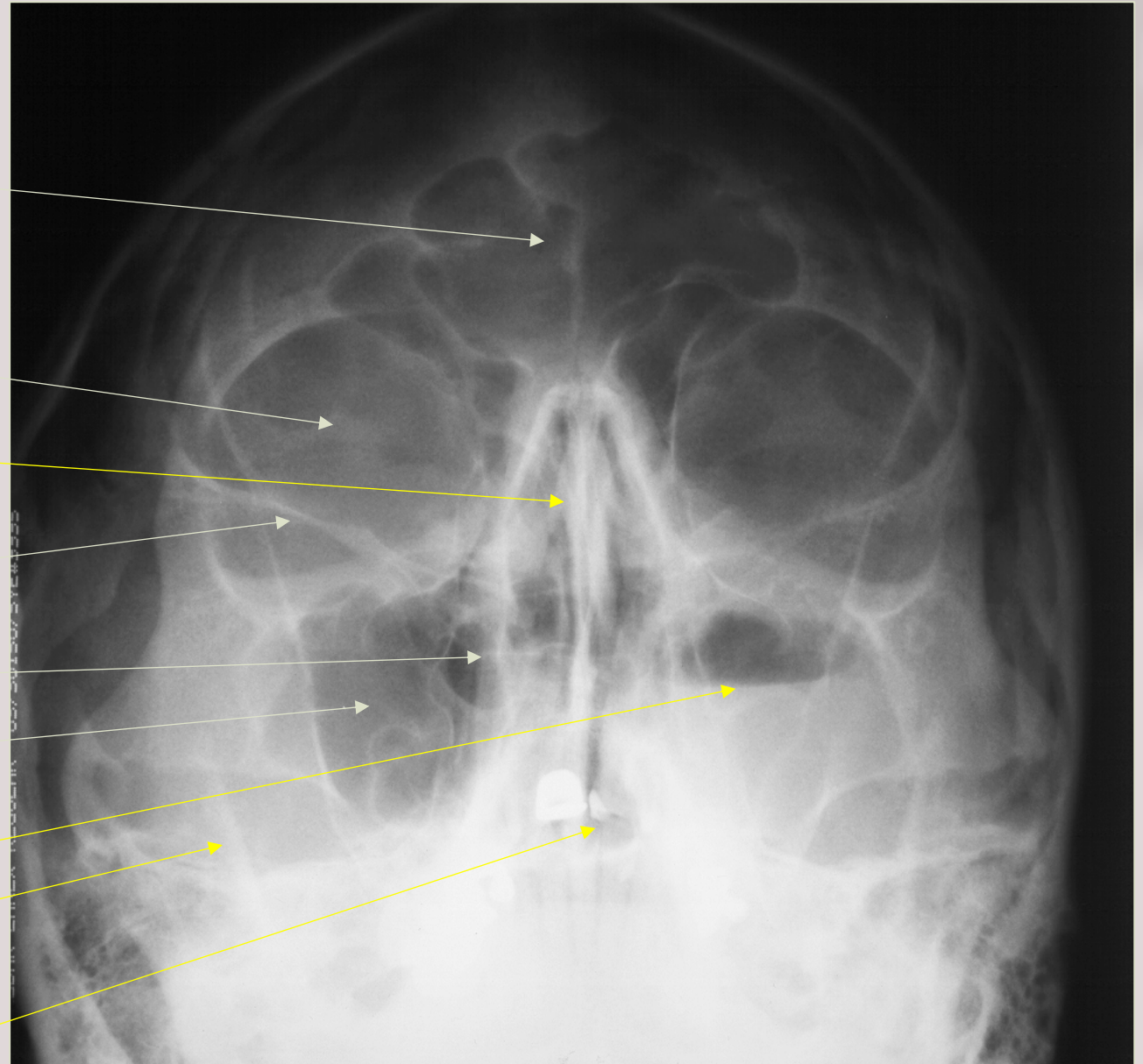
Post ethmoid sinus

Maxillary sinus

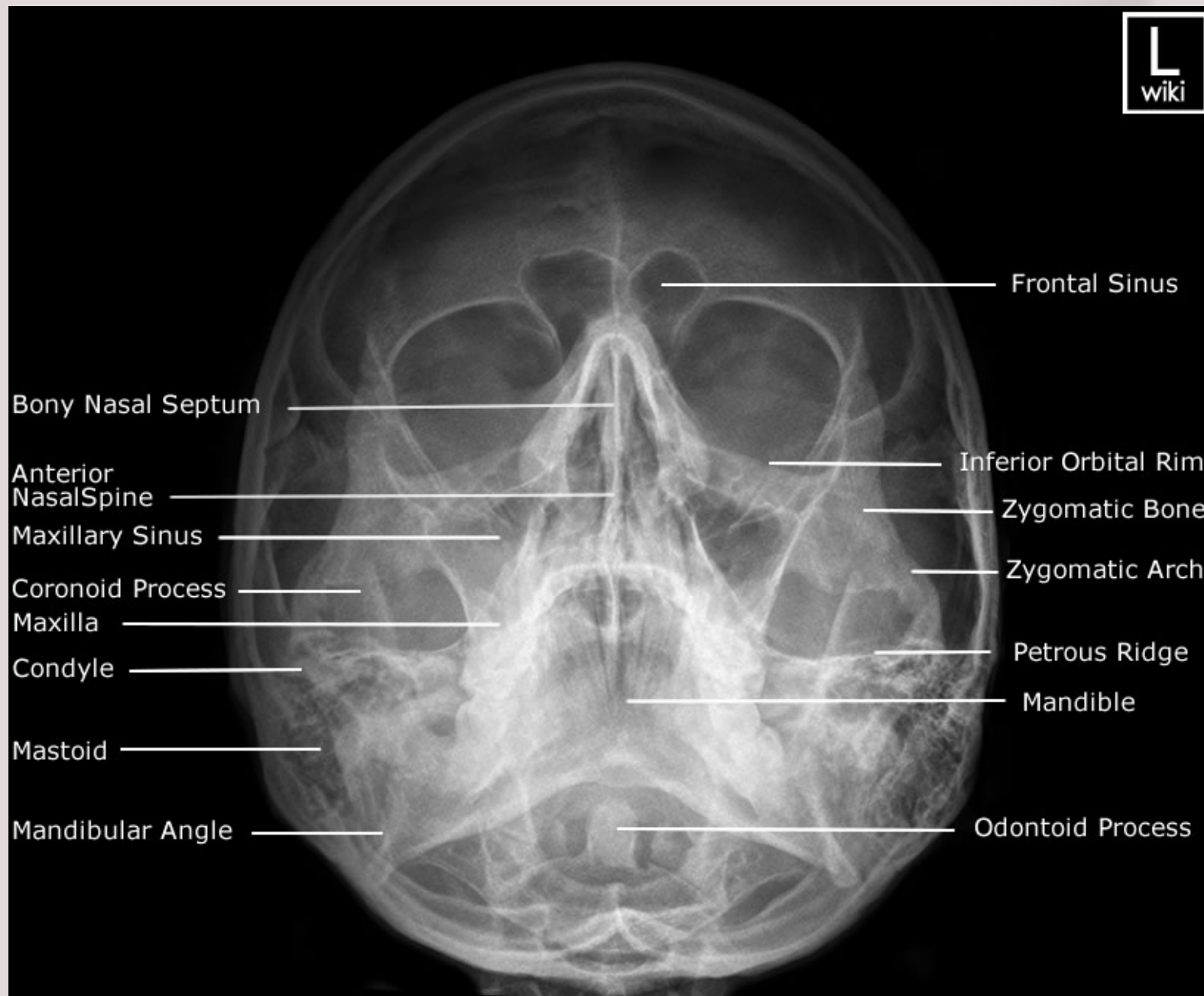
Fluid level in L.Mx.Sinus

Coronoid process

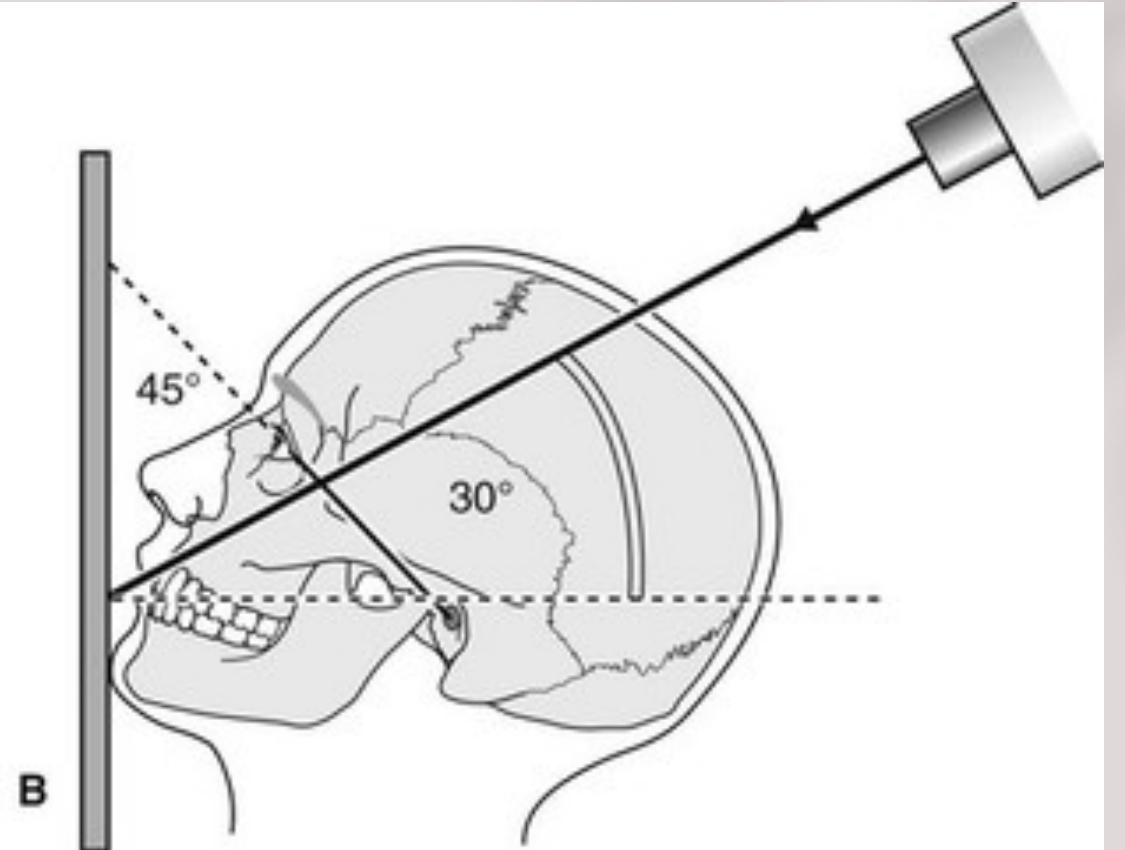
Sphenoid sinus



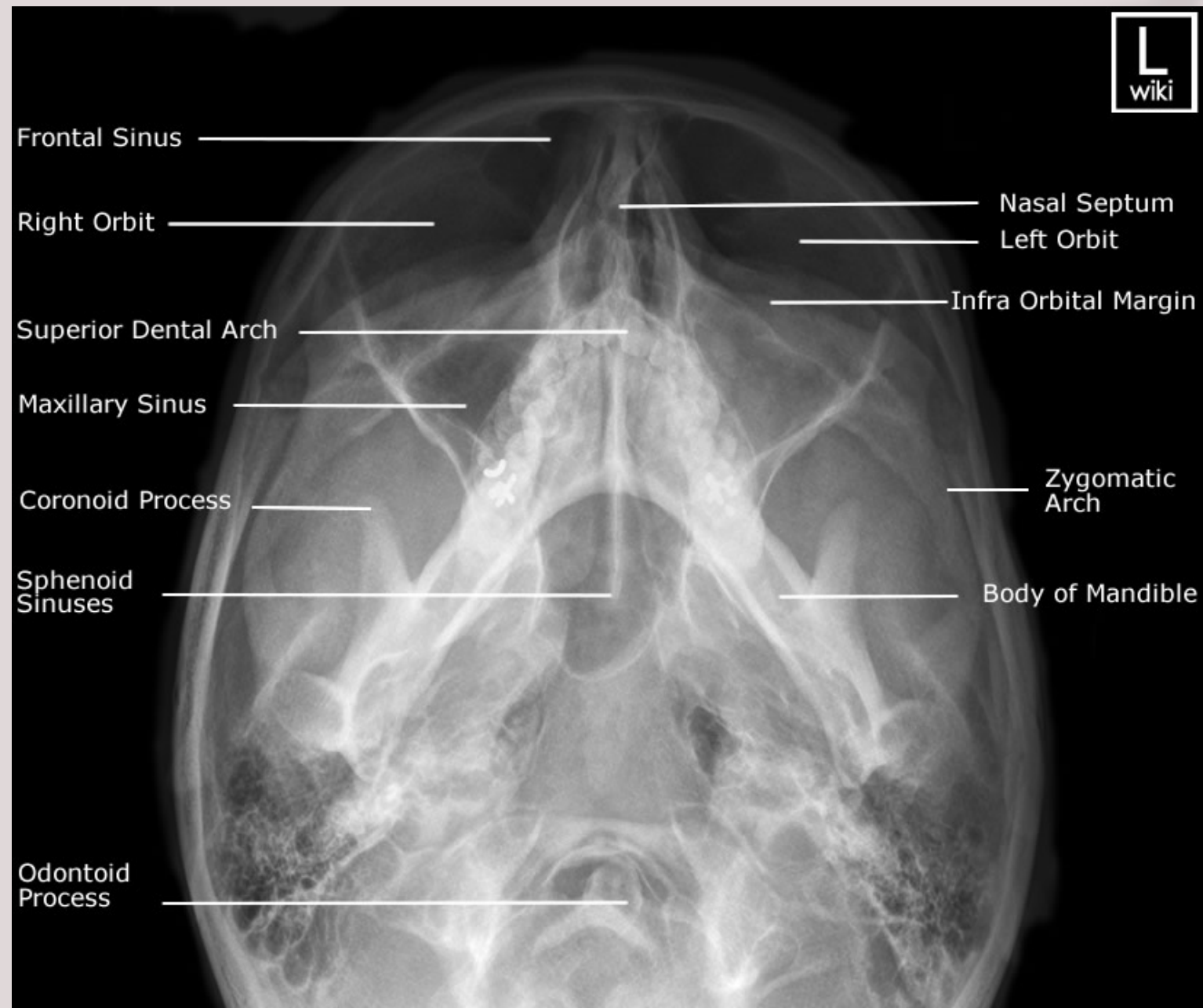
Standard Waters View



30° Occipitomenal View (30° OM)



30° Waters View
- Alternative Technique



Reverse Towne

- Patient positioning:

1. Canthomeatal line -30° & x-ray beam horizontal; OR
2. Canthomeatal line horizontal & x-ray beam -30°

- **Jaws always open!**

- Indications:

- Condylar neck fractures
- TM Joint disorder

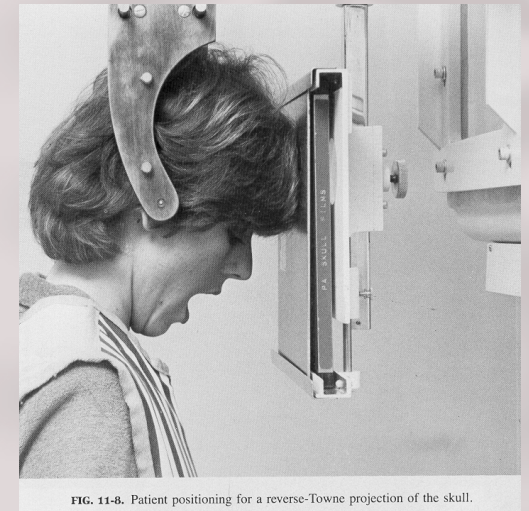
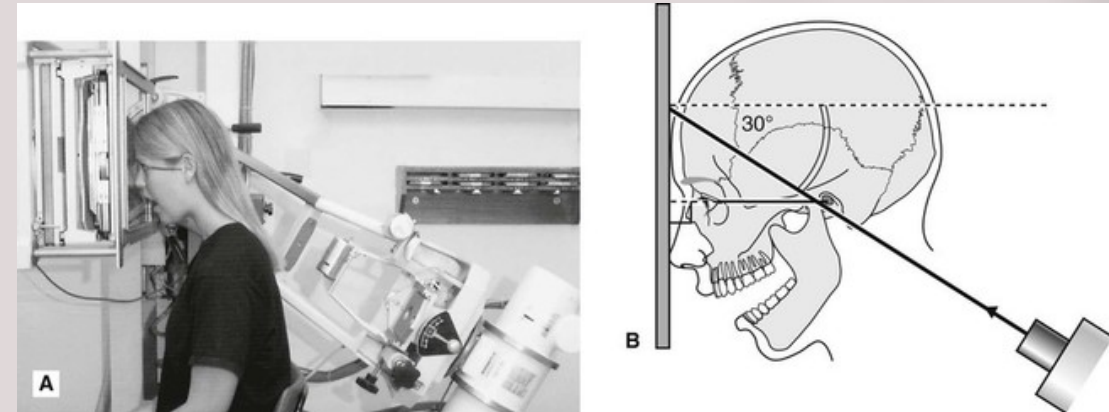
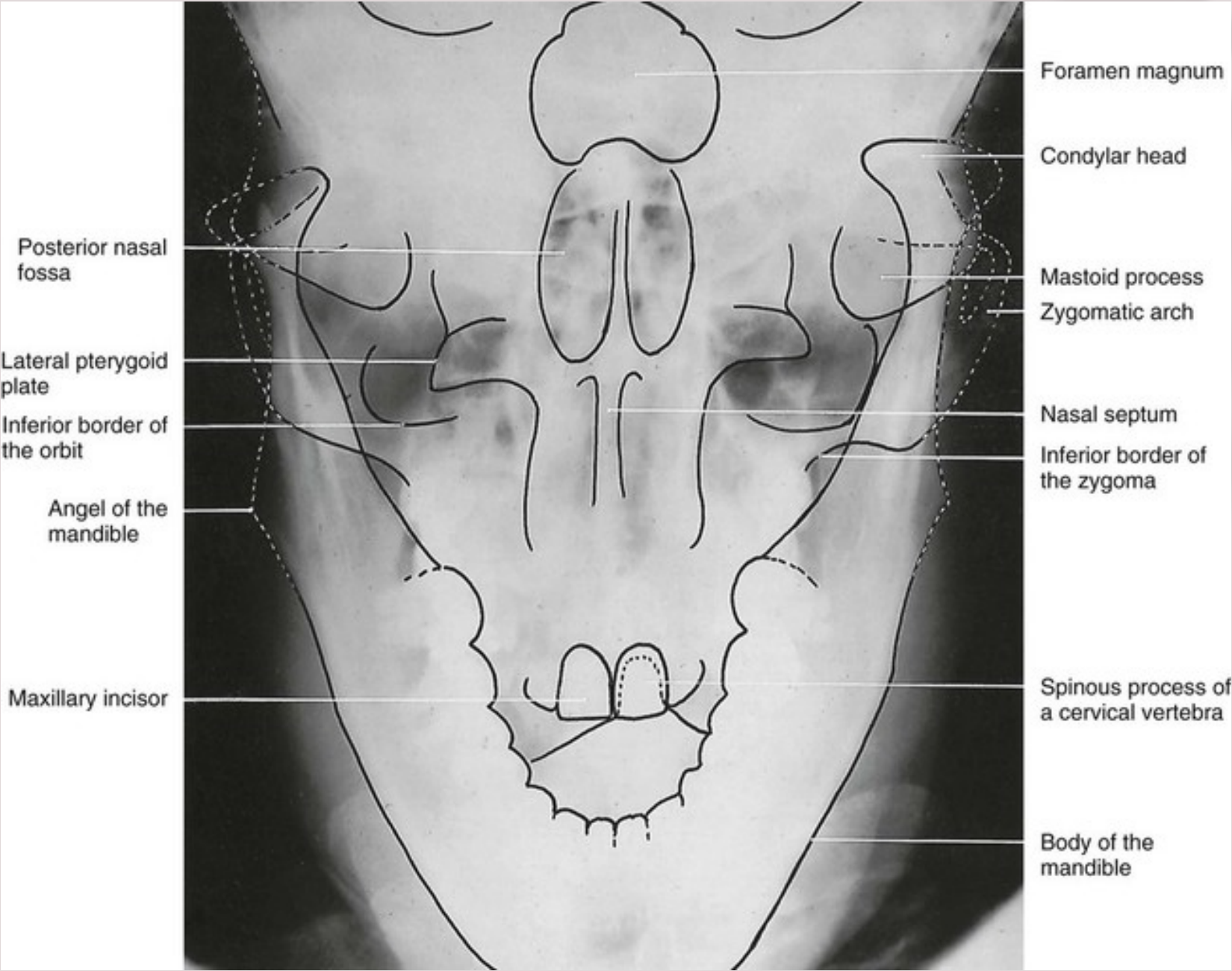
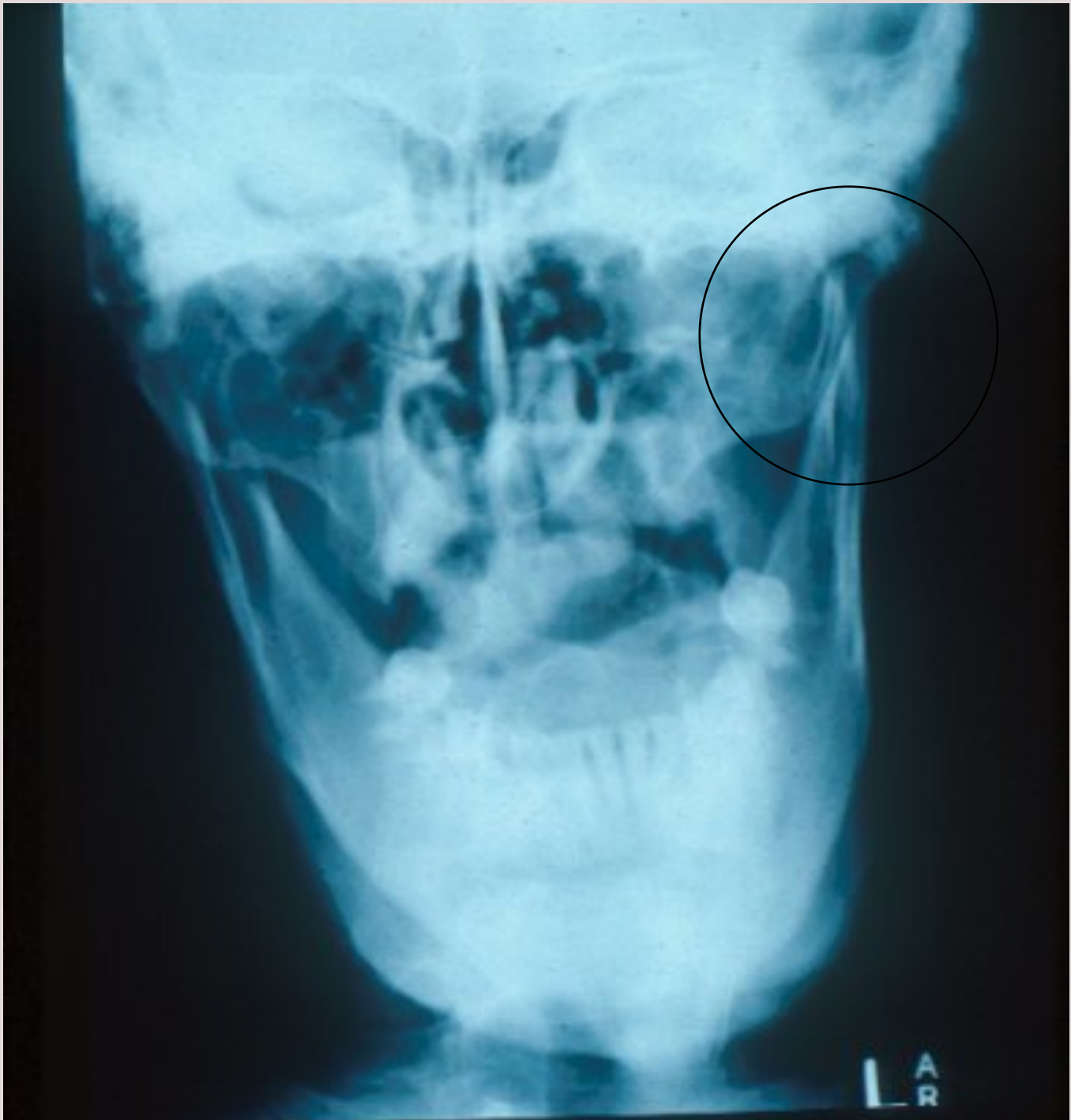


FIG. 11-8. Patient positioning for a reverse-Towne projection of the skull.



Reverse Towne Anatomy





Oblique Lateral Radiography

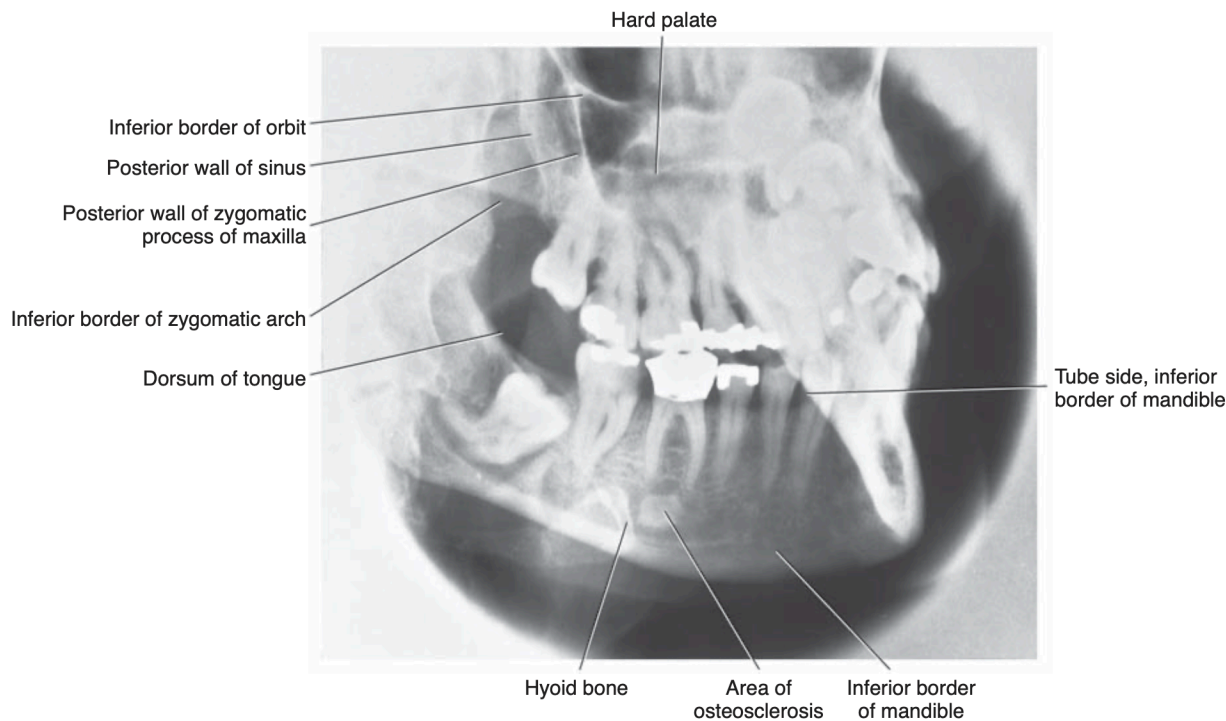


FIG. 12-7 Anatomic landmarks identified in the oblique lateral projection of the mandibular body.

Mandibular Body

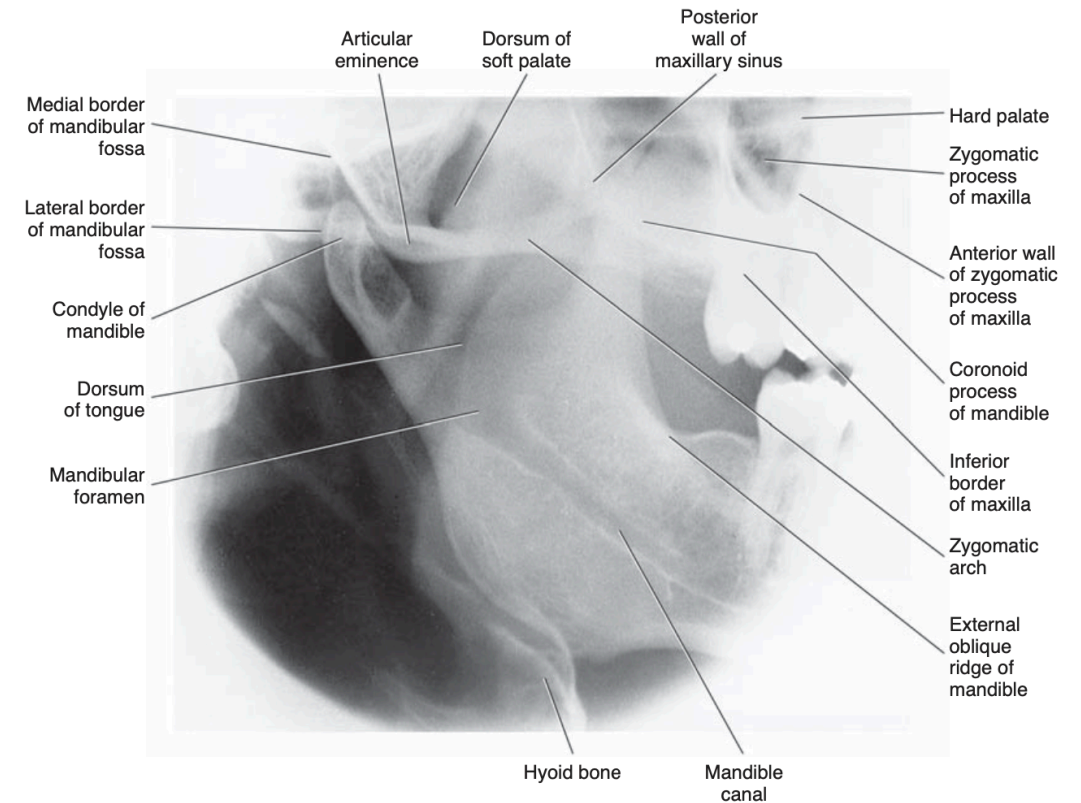
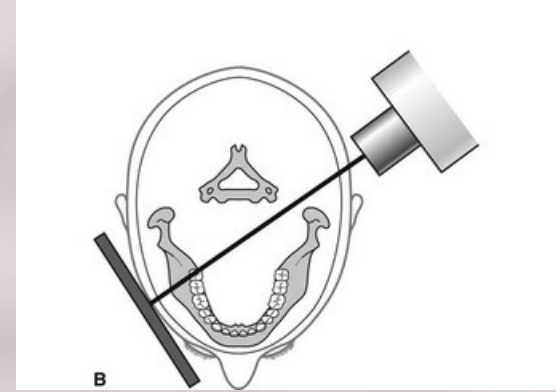


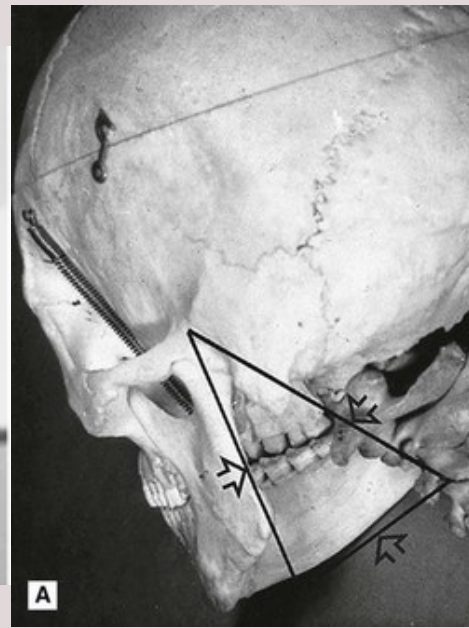
FIG. 12-8 Anatomic landmarks identified in the oblique lateral projection of the mandibular ramus.

Mandibular Ramus

Oblique Lateral Positioning



- Cassette held by the patient against the side of the face overlying the area of the jaws being investigated.
- Chin up and face rotated to the side of interest



References

- Oral Radiology Principles and Interpretation-White and Pharoah
- Essentials of Dental Radiography and Radiology - Whaites and Drage
- [http://www.wikiradiography.net/page/Facial+Bones+Radiographi
c+Anatomy](http://www.wikiradiography.net/page/Facial+Bones+Radiographi+c+Anatomy)